

P-type One-sided Hexagonal Spiral Drift Detectors

Wei Chen, Emilio Gatti* and Pavel Rehak

Brookhaven National Laboratory, *Politecnico di Milano

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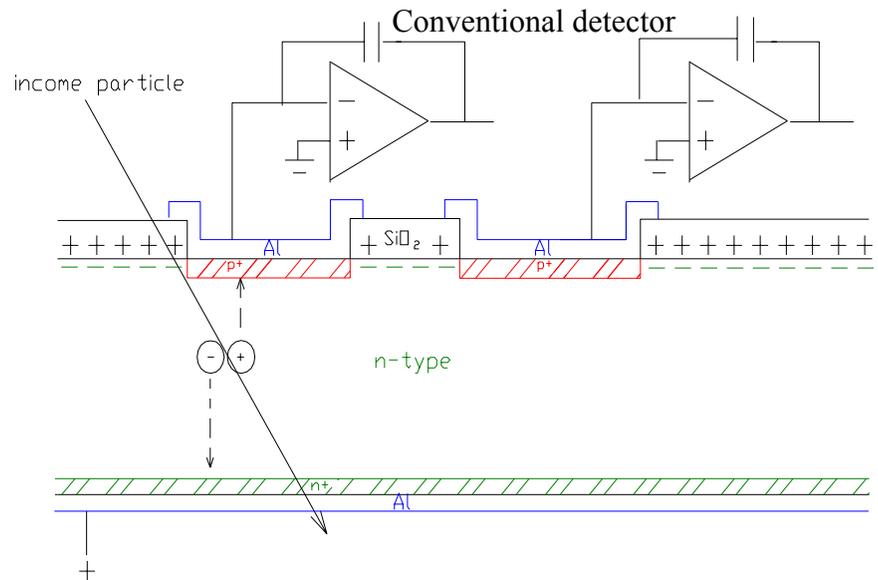
- Why one-sided hexagonal spiral drift?
- Why p-type material?
- Design, process and operation
- Test results and problems
- Conclusions

Why One-sided Hexagonal Spiral Drift

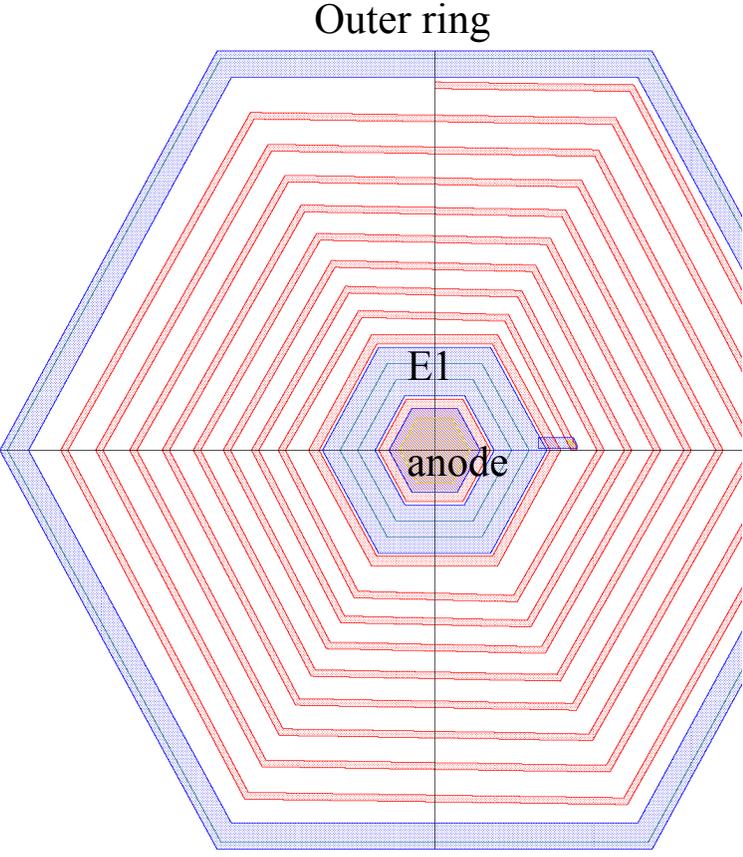
- 1) Low noise: low capacitance
low leakage current
- 2) 100% coverage
- 3) Single-sided design
- 4) As low number of bond as possible: $2/\text{pixel}$

Why P-type Material

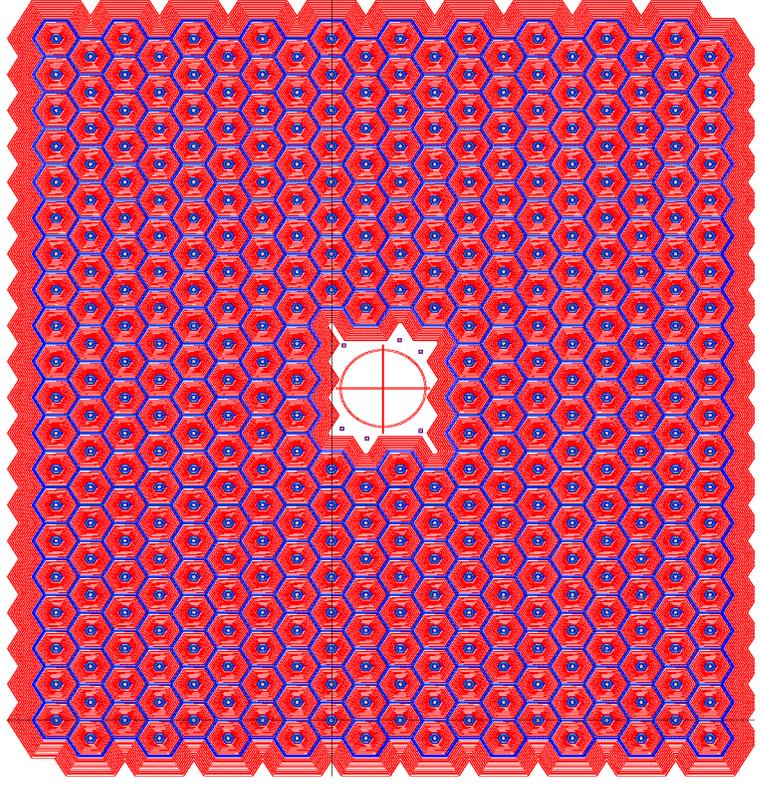
- Constraint of existing electronics
- Need positive polarity of signal



Design, Process and Operation (design)



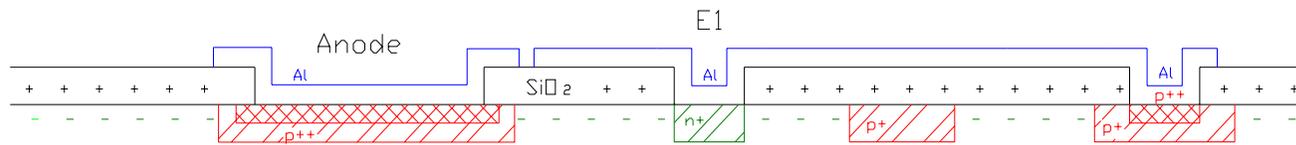
1 mm² in area



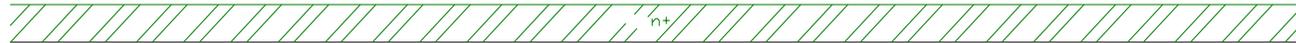
384 cells, 2x384+1 bonds

Design, Process and Operation (process)

4 masks steps

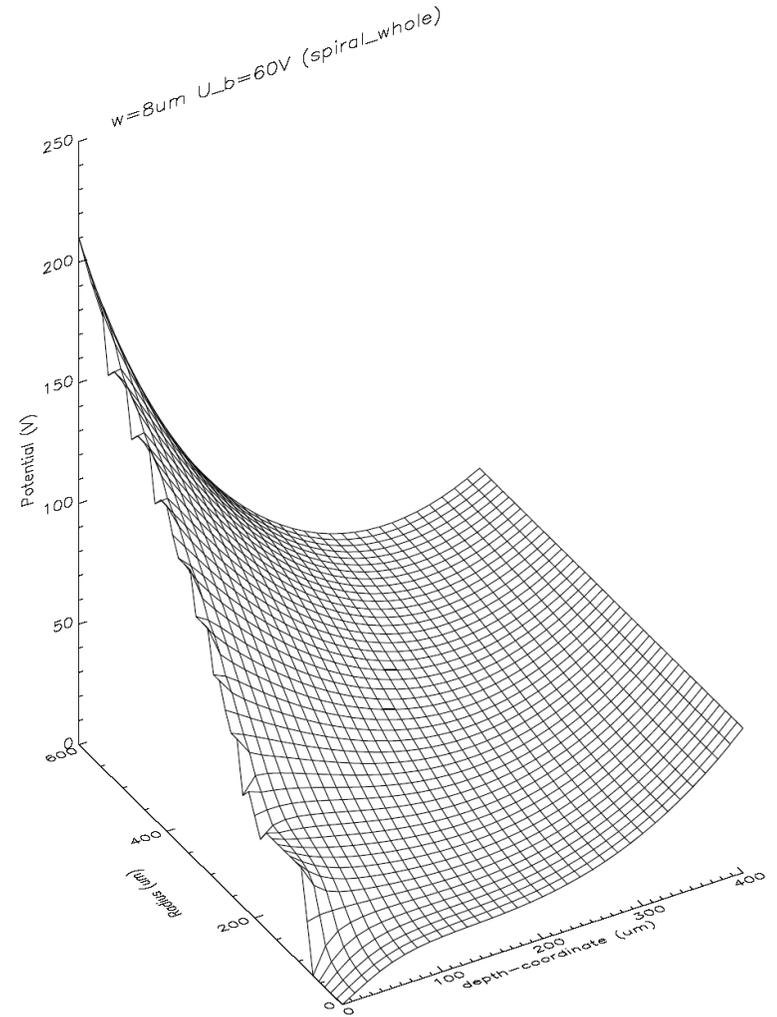
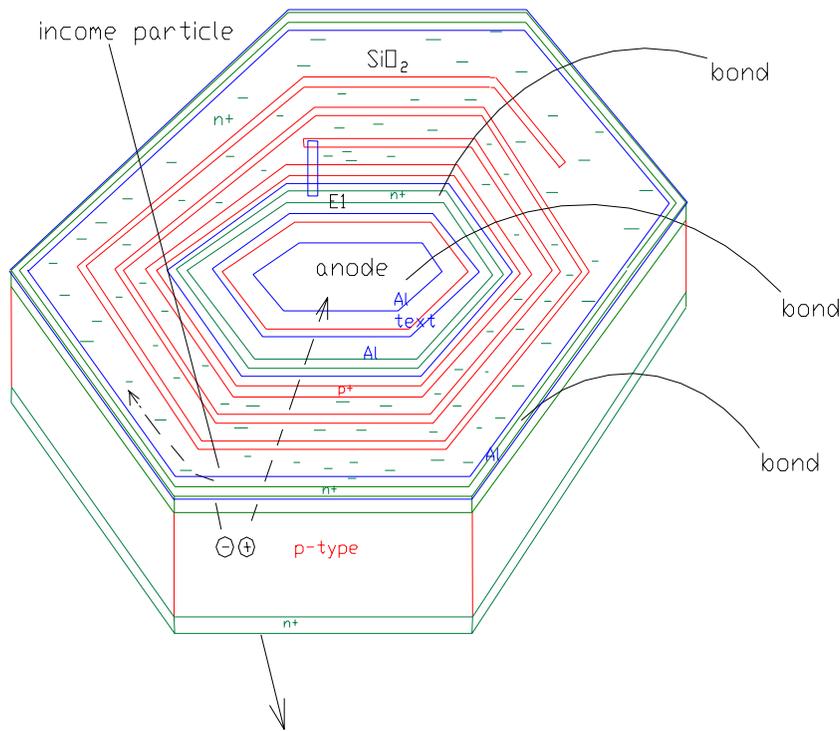


p-type

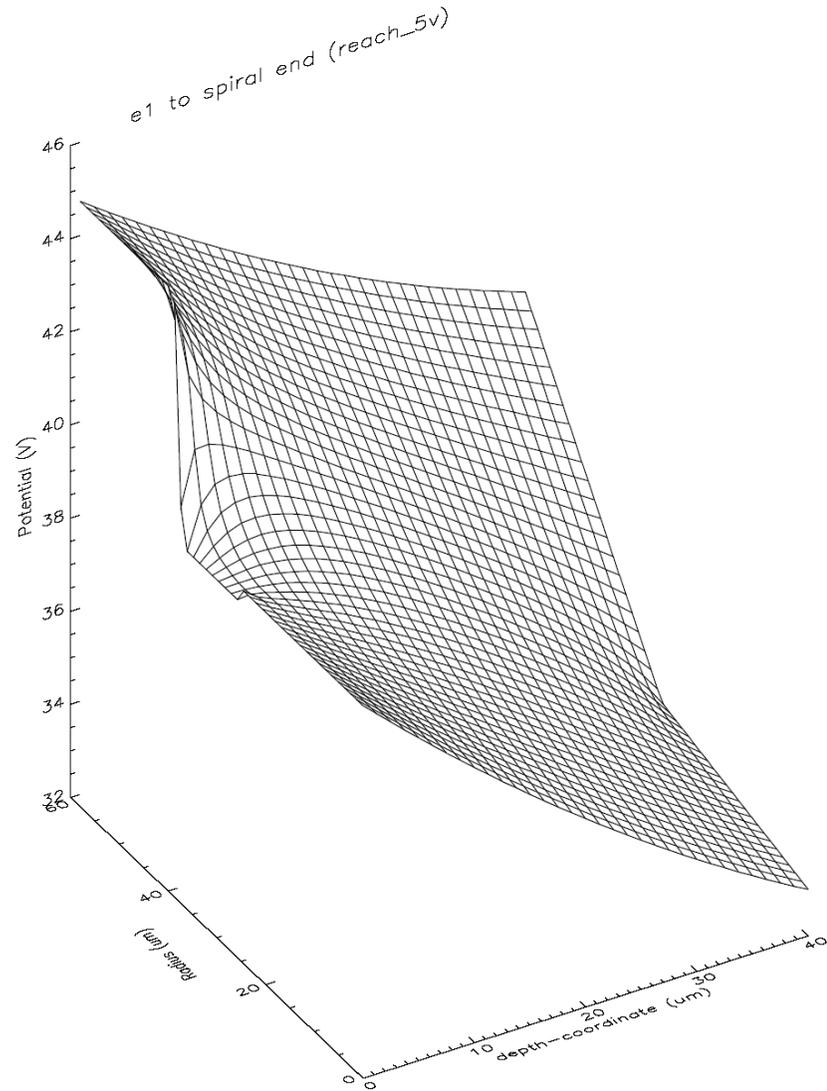
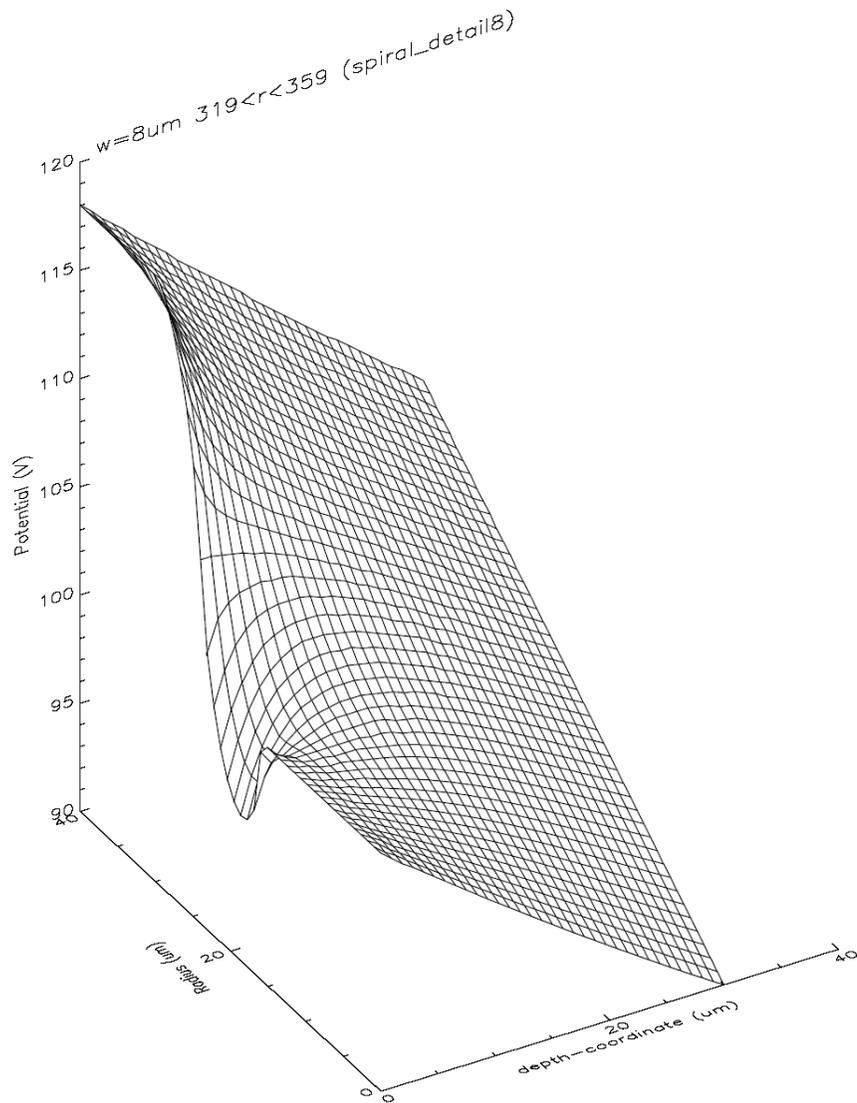


- Boron: 200keV, $8 \times 10^{11}/\text{cm}^2$
- Phos.: 20keV, $4 \times 10^{14}/\text{cm}^2$; 50keV, $4 \times 10^{14}/\text{cm}^2$
- Boron: 20keV, $2 \times 10^{14}/\text{cm}^2$; Phos.: 20keV, $4 \times 10^{14}/\text{cm}^2$; 50keV, $4 \times 10^{14}/\text{cm}^2$
- Al

Design, Process and Operation (operation)



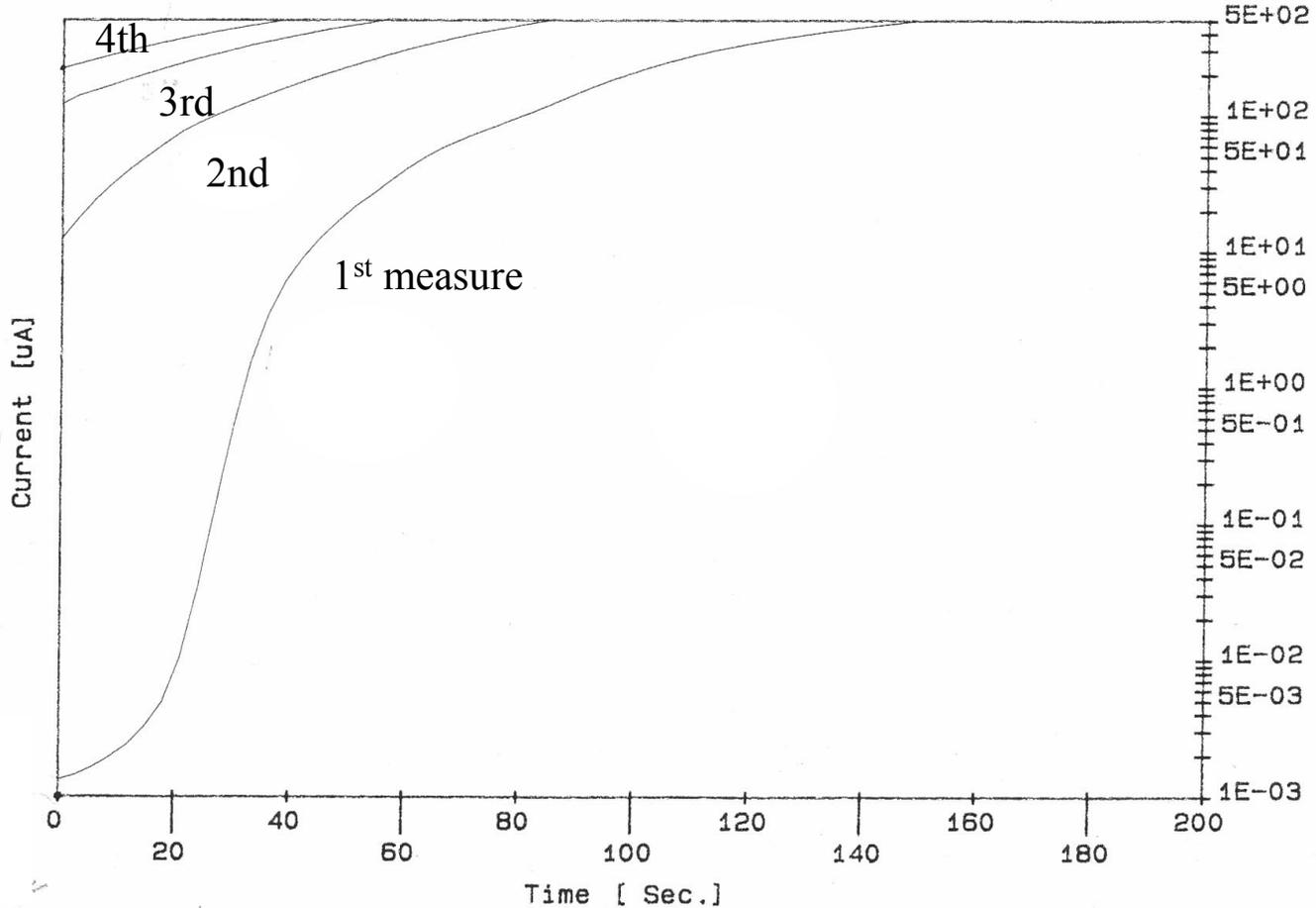
Design, Process and Operation (operation)



Test Results and Problems (instability)

Time: 15: 45: 19
Date: 10-Jun-2003

Wafer 1309. U on guarded n-diode, I from bulk



Bias-Voltage = 100.000 V : Interval-Time = 3.0 sec.

Test Results and Problems (stable)

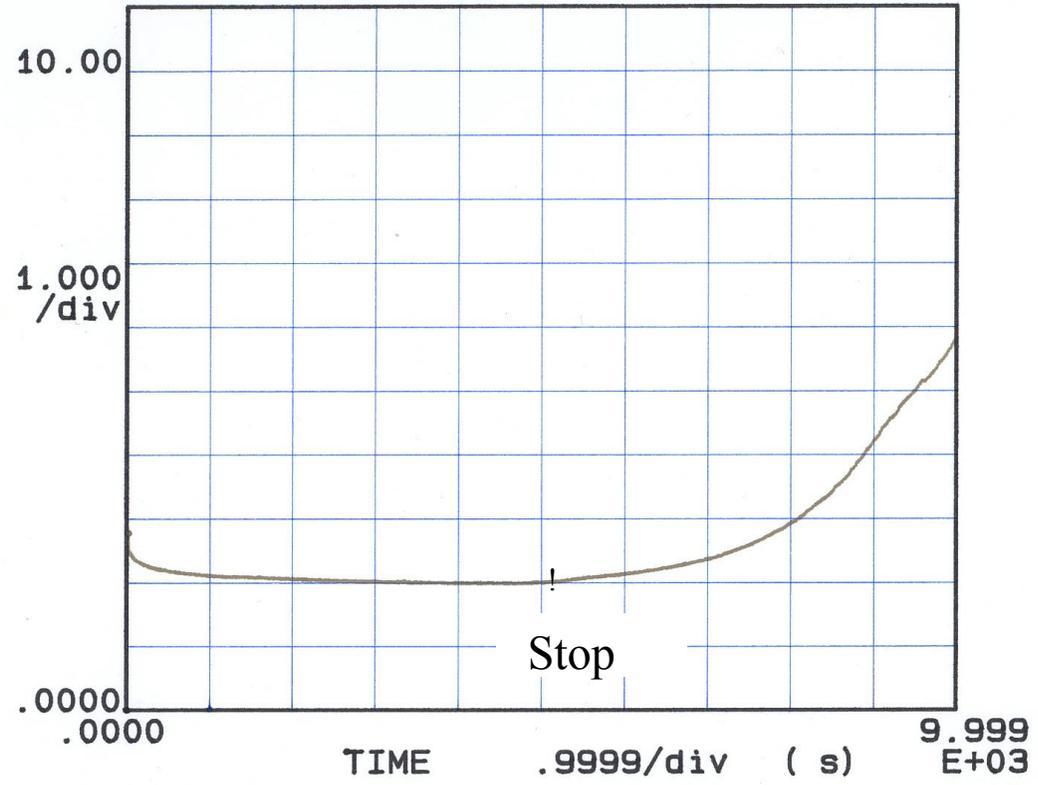
W1309 CUT AND BONDED.8/1/03

n-diode in Dry Nitrogen

Time:
Wait time .00s
Interval 10.00s
Readings 999

Constants:
VDIODE-Ch1 100.00V
V -Ch3 .0000V

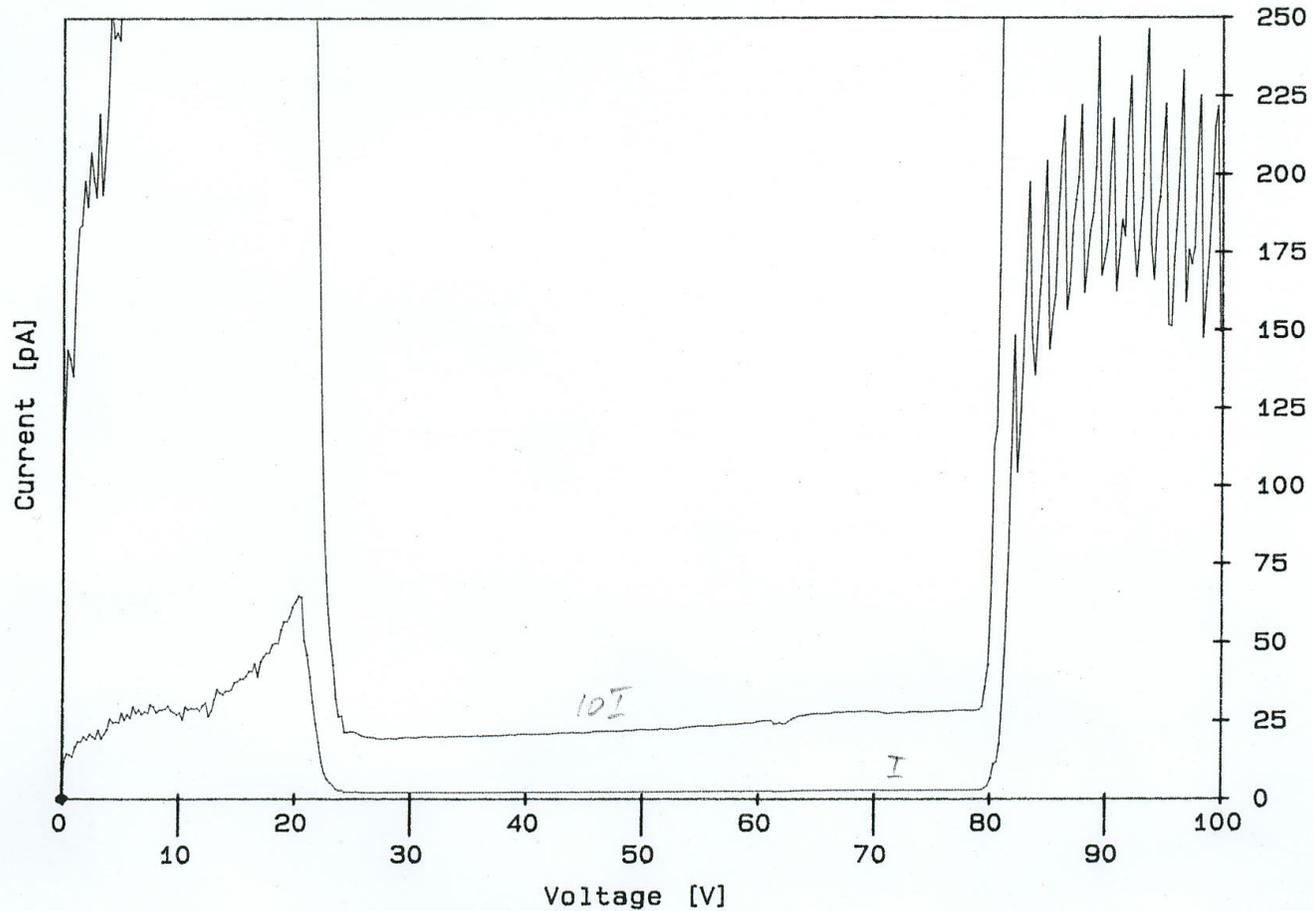
IDIODE
(nA)



Test Results and Problems (anode current)

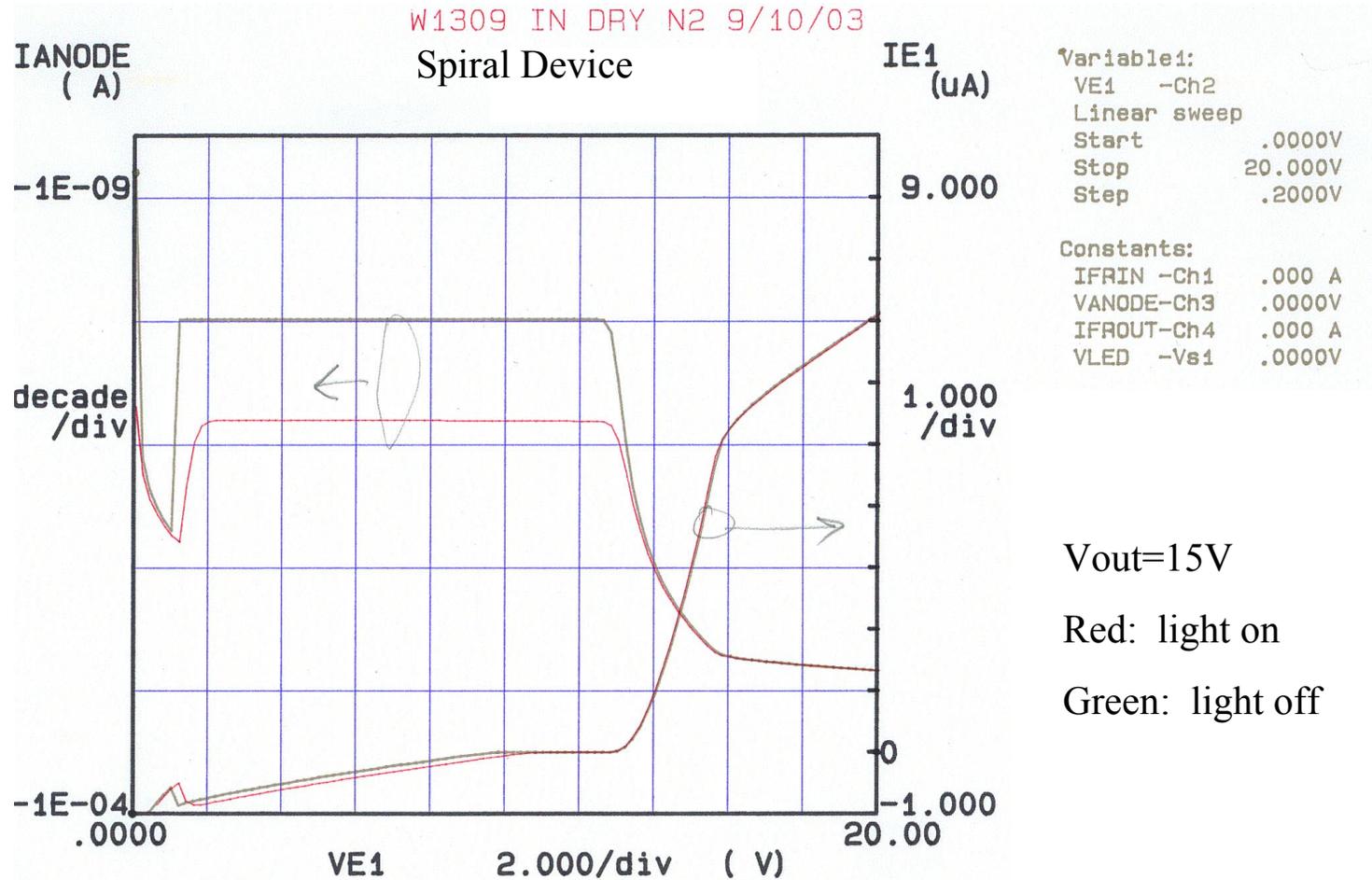
Time: 16:00:59
Date: 13-Sep-2003

W1321. Hexagonal detector. U on e1 I from anode

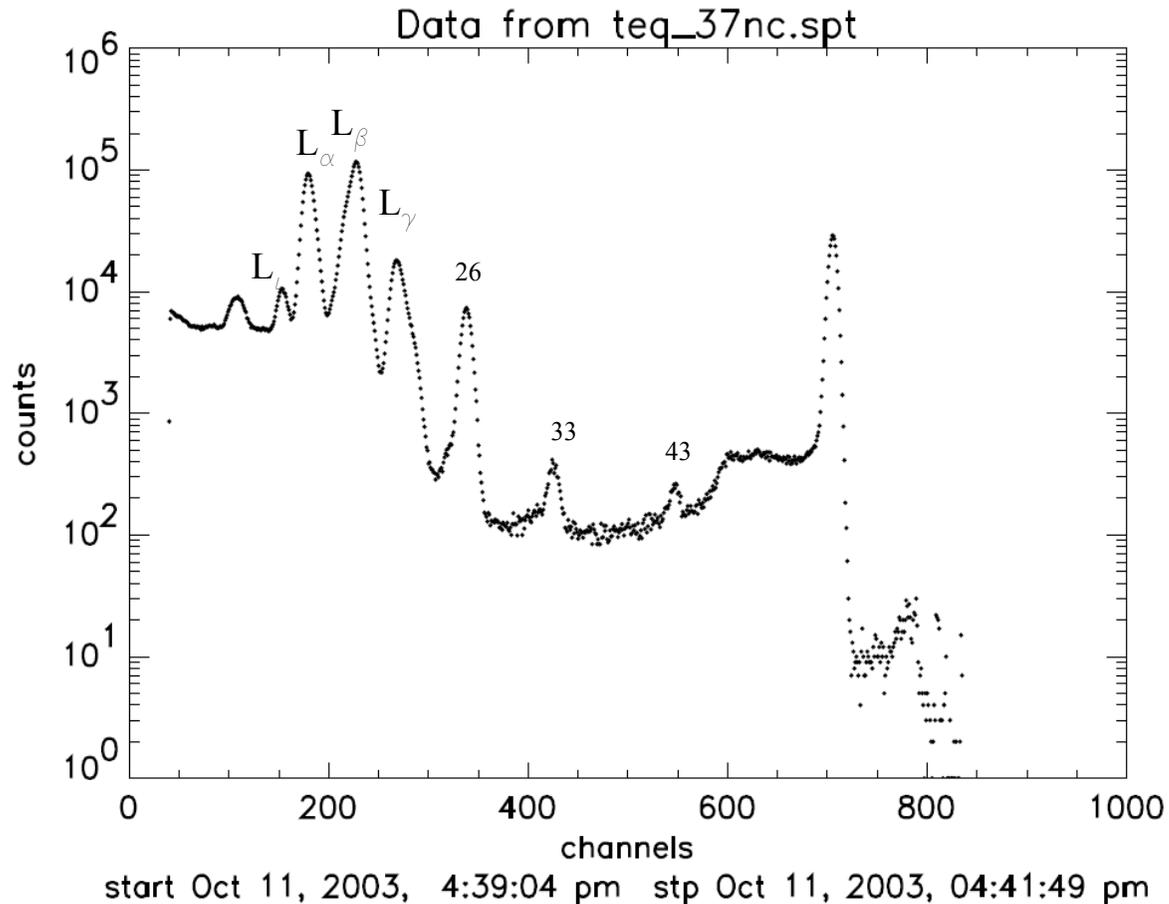


Step-Voltage = 0.250 V
Waiting-Time = 0.2 sec
Step-Voltage = 0.250 V
Waiting-Time = 0.2 sec

Test Results and Problems



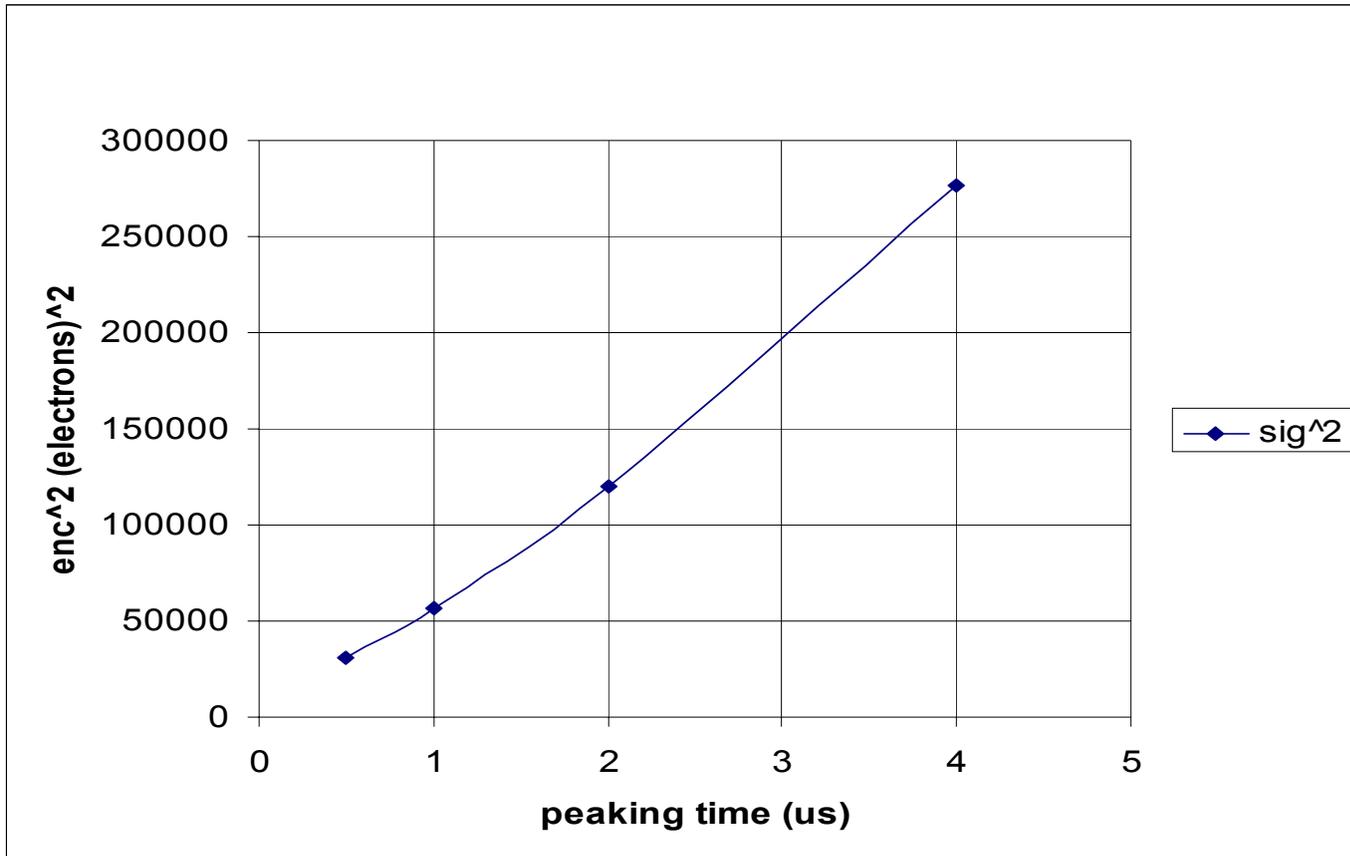
Test Results and Problems (Spectrum)



Outer ring: 150V. Back: 73V E1: 40V

Test Results and Problems (Noise)

room temperature



Conclusions

- P-type one-sided hexagonal spiral drift detectors have been produced and they work.
- Currently dry nitrogen is used for stable operation of the detector. Technological solution including additional insulating layer is being investigated.
- Resolution is limited by the high leakage current. Need to understand and reduce the leakage current.

Two groups of detectors have been produced

